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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/616,086	07/09/2003	Thomas G. Miller	5589-03501P783	9661

7590 02/18/2005
Ann Marie Mewherter
Conley Rose, P.C.
P.O. Box 684908
Austin, TX 78768-4908

EXAMINER

DEB, ANJAN K

ART UNIT PAPER NUMBER

2858

DATE MAILED: 02/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/616,086

Applicant(s)

MILLER ET AL.

Examiner

Anjan K. Deb

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-31 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 July 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 11/14/2003
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-15, drawn to computer-implemented method comprising charge density measurement, classified in class 702, subclass 84.
 - II. Claims 16-26, drawn to method of determining a thickness of an insulating film, classified in class 324, subclass 716.
 - III. Claims 27-31, drawn to method of determining a property of an insulating film, classified in class 324, subclass 663.

Distinctness

Inventions II and I are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because invention II does not require obtaining charge density measurement. The subcombination has separate utility such as for measuring the resistance and capacitance of insulating film.

Inventions III and I are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because invention III does not require obtaining charge density measurement. The subcombination has separate utility such as for measuring the resistance and capacitance of insulating film.

Inventions III and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because invention III does not require measuring a rate of voltage decay of insulating material. The subcombination has separate utility such as for determining a theoretical model of insulation.

Why Restriction is Proper

Because these inventions are distinct for the reasons given above and the search required for Group I, II and III are different, restriction for examination purposes as indicated is proper.

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During a telephone conversation with Ann Marie Mewherter, on 2/11/2005 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-15.

Affirmation of this election must be made by applicant in replying to this Office action.

Claims 16-31 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Drawings

2. The drawings are objected to because suitable descriptive labels are required in box 20, 30, 36, 38, 40 (see Fig. 3) and 48, 52 (see Fig. 2).

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “feedback control technique” in claim 14, and the “feedforward control technique” claim 15, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must

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be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 14,15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Feedback control technique recited in claim 14, and feedforward control technique recited in claims 15 are not disclosed in the specification.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1,5-11,14 are rejected under 35 U.S.C. 102(b) as being anticipated by Yun (US 3,995,216).

Re claim 1,5 Yun discloses computer-implemented (column 13 lines 63-65) method (Fig. 1) for determining one or more properties (surface states) of an insulating film (insulator-semiconductor interface)(see abstract) formed on a substrate, comprising obtaining a charge density (net charge density Q_s) (column 10 lines 30-31) measurement of the insulating film, obtaining a voltage measurement of a surface voltage potential (flat band voltage)(18,18a) of the insulating film relative to bulk voltage potential of the substrate corresponding to the charge density measurement (column 5 lines 4-32), obtaining a rate of voltage decay 81 of the voltage measurement (Fig. 5B), and determining the one or more properties (surface states) of the insulating film using the charge density measurement, the voltage measurement, and the rate of voltage decay (column 10 lines 59-68, column 11 lines 1-2, lines 43-45) as a function of altering voltage measurements.

Re claims 6-9, Yun discloses obtaining charge density measurement comprises depositing a charge (charge injection) (column 4 lines 66-68, column 5 lines 1-3) onto a surface of the insulating film, measuring the charge density (column 10 lines 59-68, column 11 lines 1-2, lines 43-45), and recording the times (T_0 , T_1 ,, T_7) at which the depositing and the measuring were performed (Fig. 5A, 5B).

Re claim 10, Yun discloses obtaining a rate of voltage decay by a theoretical model (changing $P(x,t)$ is calculable)(column 12 lines 63-68).

Re claim 11, Yun discloses measuring the voltage in accumulation, depletion, and inversion as shown in Figs. (5A, 5B, 6).

Re claim 14, Yun discloses altering a parameter (Voltage) of an instrument coupled to a process tool in response to at least one of the one or more properties of the insulating film using a feedback control technique (column 5 lines 16-32).

7 . Claims 1,2 are rejected under 35 U.S.C. 102(b) as being anticipated by Curtis (US 4,812,756) .

Re claim 1, Curtis discloses method for determining one or more properties of an insulating film (column 13 lines 53-61) formed on a substrate, comprising obtaining a charge density (column 13 line 25-30) measurement of the insulating film, obtaining a voltage measurement of a surface voltage potential of the insulating film relative to bulk voltage potential of the substrate corresponding to the charge density measurement, obtaining a rate of voltage decay of the voltage measurement, and determining the one or more properties of the insulating film using the charge density measurement, the voltage measurement, and the rate of voltage decay (column 10 lines 60-68, column 11 lines 1-10).

Re claim 2, Curtis discloses measuring capacitance and resistance (column 10 lines 3-27).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 3,4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yun (US 3,995,216) in view of Martin (US 6,600,333 B1).

Re claims 3,4, Yun discloses all of the claimed limitations including measuring capacitance except measuring resistance.

Martin discloses method of testing semiconductor device insulation film by measuring its capacitance and resistance so as to determine damage in a semiconductor device wall.

At the time of the invention it would have been obvious for one of ordinary skill in the art to modify Yun by adding measuring capacitance and resistance of an insulation film (wall) on a semiconductor device as disclosed by Martin to determine the state (thickness) of the insulating film so as to determine any damage to the wall of semiconductor device.

10. Claims 12,13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yun (US 3,995,216) in view of Wang (US 6,486,682).

Re claims 12,13, Yun discloses all of the claimed limitations except determining dielectric constant of the insulating film using capacitance and thickness.

Wang discloses determining dielectric constant of thin dielectric materials from capacitance and film thickness measurements (see column 6 lines 1-43 and Fig. 5).

At the time of the invention it would have been obvious for one of ordinary skill in the art to modify Yun by adding measuring dielectric constant of thin dielectric materials from capacitance and film thickness measurements as disclosed by Wang so as to determine the electrical insulation property of the film.

11. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yun (US 3,995,216) in view of Pasadyn (US 6,665,623 B1).

Re claim 15, Yun disclosed all of the claimed limitations as set forth above except feedforward control technique.

Pasadyn (US 6,665,623 B1) teaches a control model is used to generate control actions for changing the operating recipe settings for a process tool being controlled based on feedback or feedforward metrology for accurately measuring semiconductor device (wafer) surface property (column 2 lines 32-45).

At the time of the invention it would have been obvious for one of ordinary skill in the art to modify Yun by adding feedforward control technique disclosed by Pasadyn as an alternative to feedback control as disclosed by Yun for accurately measuring a property of insulating material.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Feuerbaum (US 4,460,866) discloses method for measuring resistances and capacitances of electronic components by depositing charge and measuring surface potential difference.

Hyde (US 3,715,656) discloses method of determining property of insulating film (dielectric constant and permittivity) by measuring charge time response to step voltage input as a function of frequency.

Fielden et al. (US 4,459,541) discloses circuit for measuring capacitance of a device under test in comparison with a reference capacitor by feedback control by monitoring the feedback current necessary to maintain the charge of a reference capacitor circuit substantially constant.

Smith (US 6,791,310 B2) discloses measuring insulation film thickness by measuring the electrical characteristics of the sample which includes measuring the voltage of the sample.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Anjan K. Deb whose telephone number is 571-272-2228. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lefkowitz Edwards can be reached at 571-272-2180.



Anjan K. Deb
Patent Examiner
Art Unit: 2858
2/15/05

Tel: 571-272-2228
Fax: 571-273-2228
E-mail : anjan.deb@uspto.gov